the extent of their original pollution and the length of their uncontaminated flow; and the impurities in suspension may to a considerable extent be removed by causing the water to remain at rest in a settling basin for a certain period before distribution, so that the larger, heavier particles are deposited at the bottom of the basin. Generally, however, after this subsidence has taken place, the finer, lighter particles and microorganisms remain in suspension in the water, as well as substances in solution; and the final purification can only be effected by filtration, assisted often by aëration, and sometimes by chemical processes.

After an introductory chapter and a chapter on intakes, sedimentation, and settling basins, the author proceeds to the consideration of his main subject, filtration. Two methods of filtration are described for the purification of water-supplies, namely slow sand-filtration, denoted as the English method, from its first introduction and general use in this country, and rapid sand-filtration, requiring the preliminary addition of a chemical solution, termed a coagulant, to render this rapid system efficient, which, being a distinctly American invention, is called the American method. Two chapters are devoted to the consideration of each of these methods in succession, the first in each case discussing the theory, efficiency, and influences of different arrangements and modifications of slow, and of rapid sand-filtration respectively, and the second chapter dealing with the design, construction, and working of slow, and of rapid sand-filters. Following these four principal chapters of the book, is a chapter giving a summary of the relative merits of the two methods of filtration; instances in which a combination of the two methods might be advantageous; and brief descriptions of the Anderson, Pasteur-Chamberland, Worms, and Maignen filtering processes. The book concludes with a chapter on the location, design, and construction of filtered-water reservoirs.

The slow sand-filtration method for the purification of water is well known, and its efficiency has been fully established by long experience in England; and it appears to be the only method, aided by aëration, by which very turbid and polluted river waters, such, for instance, as the waters of the tidal River Húgli, which have to furnish the supplies for Calcutta and Howrah, can be sufficiently purified to serve for a domestic supply. Rapid sand-filtration is a comparatively novel method of purification; and the sand filters for this process consist usually of a layer of coarse grains of quartz sand, 2½ to 3 feet thick, placed in a tank of steel, iron, or wood, from the bottom of which the filtered water is led, through strainers to prevent the escape of the sand, into pipes for conveying away the supply for distribution. Aluminium sulphate has hitherto proved the most suitable coagulant, in which the sulphuric acid enters into combination with the calcium or magnesium carbonate in the water, setting free the aluminium hydrate which forms flocculent masses with the fine suspended matter in the water, and, adhering to the grains of sand as the water passes through the filter, covers them and the bed generally with a gelatinous film, which arrests the bacteria as well as the finest particles in the water, and ensures the efficiency of the filter. When the filter becomes clogged by these impurities, as indicated by a reduction in the flow through it, the bed of sand has to be stirred up and pure water forced up through it to remove the sediment. A rapid flow is less liable to be interrupted by frost; but the proportion of coagulant required in a rapid filter changes with the varying composition of the river water, and necessitates the constant supervision of an experienced chemist to regulate the dose to the conditions, for too small a quantity would reduce the efficiency of the purification, and too large a dose would impregnate the filtered water with alum, and, during the period of low alkalinity in the flood stage of the river, would leave free sulphuric acid in the water, which would be injurious to the pipes.

INTELLIGENCE AS THE SOUL OF THE UNIVERSE.

Modern Natural Theology; With the Testimony of Christian Evidences. By Frederick James Gant, F.R.C.S., &c. Pp. xii+151. (London: Elliot Stock, 1901.) Price 2*s.* 6*d.* net.

IT is no doubt true that the older form of the "argument from design" is more or less discredited by the doctrine of evolution. Nevertheless, the author of the book before us is justified in holding that the argument itself is not disposed of, and that in a setting more strictly accordant with our present knowledge than that which Paley gave it, it is still a powerful weapon in the hands of the natural theologian. More, indeed, is gained under the conception of organic growth than is lost by the sacrifice of the older teleology; for Paley's statement of the case savours of deism, whereas under the more recent view there are distinct indications in the universe of a purpose which may be called moral. In so far as such a purpose is discoverable in nature, to that extent does deism retire into the background. This is the aspect of the matter which is put forcibly, if not very intelligibly, in the work before us. The difficulties inherent in the materialistic as well as the deistic position are, on the whole, well stated, and the way is shown to be open for the recognition of intelligence as the "mind or soul of the universe." Though the author guards himself in words which are capable of an orthodox interpretation, it may be questioned whether the argument from nature, in his way of presenting it, necessarily excludes pantheism. Mr. Gant would probably appeal to the second part of his book—which, dealing as it does more particularly with historical evidences, is somewhat outside our province—as supplying the needful corrective. On the whole, however, it must be allowed that, though his personal convictions are not in doubt, his reading of natural phenomena is more successful as a criticism of the deistic position than as an attack on pantheistic interpretations.

The book would have been better adapted for its purpose if its author had developed his argument in simpler language and with stricter attention to the ordinary rules of composition. Instances of confused diction are numerous; for example:—

"In all sentient living beings, mind is much moved by suffering for the maintenance, and thence the prolongation of life" (p. 54).

"Thus living beings tell their own story of identifica-

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tion with living species, or declare their bygone existence as extinct species" (p. 62).

Here Mr. Gant's meaning can only be guessed at. In other cases, though the sense may be easy to grasp, the language shows an almost Thucydidean disregard of grammatical construction. The following passage may serve as an instance:—

> "This law of orderly sequence . . . is unlimited in the extent of its operation; and having produced the face of Nature she now presents, so, doubtless, will the portrait change in the future" (p. 68).

Here is a not unfair specimen of the author's way of overloading his sentences:—

> "The moveable coccyx terminates in a blunt point, which . . . is a rudimentary *tail*; with which so many animals are provided, with diverse uses, in climbing, *e.g.*, some apes; as an additional leg in bounding, or a formidable weapon for striking, *e.g.*, the kangaroo" (p. 40).

This calls for criticism in more respects than one.

We pass over Mr. Gant's views on the subject of heredity. They are open to question, but the main point at issue is immaterial with regard to the purpose of the book. The like may be said of a curious misuse of the term "natural selection" on p. 42. The reference to spiders and scorpions as "insects" is less excusable.

It is fair to state that the abrupt and disjointed style—to use no harsher terms—into which the author so frequently falls does not appear to reflect a corresponding incoherence of thought. Within certain limits, his chapters give the impression that what he has to say, if he could only express it fitly, would be worthy of attention. It is unfortunate that he has failed to find a more attractive method of imparting conclusions many of which are in themselves sufficiently sound and sensible.

OUR BOOK SHELF.

The Distribution of Rainfall over the Land. By Andrew J. Herbertson, Ph.D., F.R.S.E. With 13 maps and a plate. (London: John Murray, 1901.)

EVERY meteorologist will be most glad to possess this very valuable work on the distribution of rainfall over the earth's surface. Dr. Herbertson seems to have spared no pains to utilise all the available material, and the result is that he is able to present us with rainfall maps for every month in the year, giving not only the seasonal distribution of rain, but a knowledge of the actual amount. Each map is accompanied by general remarks as to the position of the pressure belts, wind systems, and other useful information which are fundamental in studying the weather from month to month. Further, a map, with descriptions, &c., is given, illustrating the mean annual rainfall over the land surface. The book includes also a very useful set of curves showing the monthly distribution of rainfall in percentages of the annual fall for seventy-four selected stations. From these it can be seen at a glance whether a station receives the majority of its rainfall at one period of the year, such as Bombay, Pekin, Bathurst, &c., or whether there are two periods of rainfall each year, as at Colombo, Lagos, Peshawar, &c. The importance of keeping separate the rainfall that is received at one place during a year at the two monsoons and not combining them when there happen to be two periods of rainfall is of fundamental importance at the present day, and the volume before us will help to show when the yearly mean alone may be used. Dr. Herbertson concludes this valuable addition to the meteorological library by giving the data he used in drawing the maps, namely a useful bibliography, and tables showing each station, latitude and longitude of each, the period over which rainfall observations have been made, the altitude, and, lastly, the mean rainfall for the period for each month.

Tierleben der Tiefsee. Von Oswald Seeliger. Pp. 49. (Leipzig: W. Engelmann, 1901.) Price 2*s.*

THIS is a popular exposition, by a well-known and thoroughly competent zoologist, of the leading features of deep-sea life and of the conditions under which it exists. It is, of course, primarily for German readers, and is evidently, and very properly, intended to direct attention to the recent German Deep-Sea Expedition. The results of the preceding "Plankton" Expedition are also referred to. The little book contains about fifty pages, of which the first thirty constitute the essay proper and the remaining twenty are notes upon paragraphs and statements in the text, and give references to the literature of the subject. In such limited space it is obvious that no exhaustive treatment is possible; many important matters are barely mentioned, and in fact the whole can only be regarded as, at most, a sketch of this large department of oceanography.

The subjects dealt with are:—depths, pressure and its effects, the distribution of temperatures, the penetration of sunlight, the deep-sea deposits, the question of food, the bipolar theory of distribution, the presence of very ancient animal types, the so-called "living fossils," and the "phosphorescence" of the sea, with some account of the light-producing organs of certain Crustacea and fishes. There is also scattered through the pages a certain amount of discussion of the characteristics and distribution of deep-sea animals.

The essay is illustrated by one coloured plate entitled "Tiefsee-Idyll," showing, not too clearly and without sufficient delicacy of detail, about twenty species of deep-sea animals belonging to various groups. It is intended to demonstrate the characteristic colours, and especially the red coloration of so many abyssal Crustacea, Echinodermata and Cœlenterata when they are brought to the surface. Both in drawing and colouring, however, the plate is rather crude, and probably gives an incorrect impression by showing so many different kinds of animals packed so close together in a very small area.

W. A. H.

A Guide to the Shell and Star-fish Galleries (Mollusca, Polyzoa, Brachiopoda, Tunicata, Echinoderma and Worms), in the British Museum (Nat. Hist.). Pp. v + 130; illustrated. (London: Printed for the Trustees, 1901.)

THIS admirable little work, written by Messrs. Smith, Bell and Kirkpatrick and sold for sixpence, may be described as the best and cheapest elementary natural history of the groups of which it treats hitherto published. A large number of excellent text-figures (some original and others borrowed from well-known works) illustrate the leading external and anatomical characters of the more important types. And although in certain places the text is necessarily somewhat technical, the diagrammatic illustrations render the meaning and application of the special terms so easily understood that every reader ought to experience little difficulty in gaining a general idea of the various groups described. This feature of the work is specially noticeable in the case of the polyzoans, whose structure often forms a stumbling-block to the beginner; and we know of no other book containing such a number of excellent figures of this group in such a small space.

The authors have not been unmindful of the economic side of zoology; and the reader will find much to

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